April 2011 JPM / CS / APS / EPSS /PSHS Joint Subcommittee Meeting
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ABSTRACT INFORMATION

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MANAGEMENT APPROVAL

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ABSTRACT SUBMITTAL FORM

Unclassified Abstract
(250-300 words; do not include figures or tables)

A major motivation of the Ares I-X flight test program was to Design for Data, in order to maximize the usefulness of the data recorded in support of Ares I modeling and validation of design and analysis tools. The Design for Data effort was intended to enable good post-flight characterizations of the flight control system, the vehicle structural dynamics, and also the aerodynamic characteristics of the vehicle. To extract the necessary data from the system during flight, a set of small predetermined Programmed Test Inputs (PTIs) was injected directly into the TVC signal. These PTIs were designed to excite the necessary vehicle dynamics while exhibiting a minimal impact on loads. The method is similar to common approaches in aircraft flight test programs, but with unique launch vehicle challenges due to rapidly changing states, short duration of flight, a tight flight envelope, and an inability to repeat any test.

This paper documents the validation effort of the stability analysis tools to the flight data which was performed by comparing the post-flight calculated frequency response of the vehicle to the frequency response calculated by the stability analysis tools used to design and analyze the preflight models during the control design effort. The comparison between flight day frequency response and stability tool analysis for flight of the simulated vehicle shows good agreement and provides a high level of confidence in the stability analysis tools for use in any future program. This is true for both a nominal model as well as for dispersed analysis, which shows that the flight day frequency response is enveloped by the vehicle's preflight uncertainty models.

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3	Propulsion Systems for Space Access	Explosive Performance/ Enhanced Blast	Scramjet Propulsion/Structures	Exhaust Plume Effects	Insensitive Munitions Technology
4	Gun and Gun-Launched Propulsion	Airbreathing Combustion	Scramjet Component/Engine Testing	Other Exhaust Plume Related Problems	Gun Propellant Vulnerability
5	Propulsion and Energetics Test Facilities	Combustion Diagnostics	Combined/ Advanced Cycle Propulsion	Signatures and Spectral and In-Band Radiometric Imaging of Targets and Scenes (SPIRITS)	Propulsion Systems Safety and Hazard Classification
6	Sensors for Propulsion Measurement Applications	Liquid, Hybrid, and Novel Propellants Combustion	Small/Expendable Turbopropulsion		
7			Fuel Technology		
8			Component Modeling and Simulation		